YELLOW STARTHISTLE INFORMATION

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IMPACT

Rangelands

Although no economic assessments have been conducted for yellow starthistle, millions of dollars in losses probably occur from interference with livestock grazing and forage harvesting procedures, and lower yield and forage quality of rangelands (Callihan et al. 1982, Roché and Roché 1988). Because of the spiny nature of yellow starthistle, livestock and wildlife avoid grazing in heavily infested areas. Thus, yellow starthistle can greatly increase the cost of managing livestock. Although the nutritional component of yellow starthistle leaves is high during the growing season (Callihan et al. 1995), its nutrient value declines as the plants mature. Yellow starthistle in the pre-spiny stage contains between 8 to 14% protein (Thomsen et al. 1990). However, an analysis of the nutritional status of cattle manure in the fall indicated that yellow starthistle-infested pastures contain considerably less crude protein and total digestible nutrients compared to uninfested pastures (Barry 1995).

Other impacts

In addition to rangeland, pastures and grasslands, yellow starthistle is the most important roadside weed problem in much of central and northern California and has, on occasion, caused problems in dryland cereals, orchards, vineyards, cultivated crops, and wastelands (Maddox et al. 1985). It can also reduce land value and reduce access to recreational areas (DiTomaso et al. 1998, Roché and Roché 1988). In addition, starthistle infestations can reduce wildlife habitat and forage, displace native plants, and decrease native plant and animal diversity (Sheley and Larson 1994a). Dense infestations not only displace native plants and animals, but also threaten natural ecosystems and nature reserves by fragmenting sensitive plant and animal habitat (Scott and Pratini 1995). A related species, *Centaurea melitensis* (tocalote), significantly reduces the seed production of the endangered plant species *Acanthomintha ilicifolia* (E. Bauder unpublished data) and yellow starthistle invasions on the Agate Desert Preserve in southwest Oregon threatens *Lomatium cookei*, a globally rare plant species (Randall 1994).

Water consumption

Recent studies indicate that yellow starthistle significantly depletes soil moisture reserves in annual grasslands in California (DiTomaso et al. 2000a, Dudley 2000) and in perennial grasslands in Oregon (Borman et al 1992). Because of its high water usage, yellow starthistle threatens both human economic interests as well as native plant

ecosystems (Dudley 2000). It was recently acknowledged by the State Water Resources Control Board that control of weeds could significantly conserve water. Based on a conservative estimate of the weeds coverage in the Sacramento River watershed, Gerlach estimated (Dudley 2000) that yellow starthistle may cause an economic loss of $16 to $56 million in water conservation per year.

Toxicity to horses

Numerous reports have characterized the toxic effect of yellow starthistle on horses (Cheeke and Shull 1985, Cordy 1978, 1954a, b, Kingsbury 1964, Larson and Young 1979, Martin et al. 1971, McHenry et al. 1990, Mettler and Stern 1963, Panter 1990, 1991, Young et al. 1970). When ingested by horses, yellow starthistle causes a neurological disorder of the brain called nigropallidal encephalomalacia or "chewing disease". Continued feeding results in brain lesions and mycosal ulcers in the mouth (Kingsbury 1964). There is no known treatment for horses that have been poisoned by yellow starthistle and in most cases the animals will die from starvation or dehydration (Panter 1991).

Poisoning is a chronic condition affecting horses primarily after animals have ingested fresh or dried plant material over an extended period, typically for 30 to 60 days, at cumulative fresh weight of 60 to 200% of an animal's body weight (Panter 1990, 1991). Cheeke and Shull (1985) reported the lethal dose to be 2.3 to 2.6 kg yellow starthistle per 100 kg of body weight per day. The clinical signs of poisoning include drowsiness, difficulty in eating and drinking, twitching of the lips, tongue flicking, and involuntary chewing movements. The peak months of poisoning are mid-summer (June-July) and more importantly mid-fall (October-November) (Cordy 1954a, b, 1978). The summer peak is associated with the rapid growth phase following spring and the second peak is likely due to autumn rainfalls that stimulate growth of plants surviving through the summer.

Yellow starthistle poisoning is generally most dangerous when it is the only feed available or when it is a significant contaminant of dried hay. In some cases, horses acquire a taste for yellow starthistle and seek it out even when other forage is available (Panter 1991). In northern California in 1954, it was estimated that at least 100 cases of horse poisoning by yellow starthistle occurred annually (Cordy 1954b). Because the toxicity and identification of starthistle is better understood today, veterinarians and researchers note that cases of yellow starthistle poisoning in horses are now relatively uncommon (Seagall, pers. comm.).

The symptoms of yellow starthistle poisoning resemble Parkinson's disease in humans (Panter 1991). Because of this similarity, it has been suspected that repin, a sesquiterpene lactone isolated from yellow starthistle, may be responsible for the symptoms in horses (Akbar et al. 1995, Hamburger et al. 1993, Merrill and Stevens 1985). Repin has been shown to cause neurological disorder in other animals (Robles et al. 1998). This compound is also found in Russian knapweed (*Acroptilon repens*) (Cassady et al. 1979), which is also known to poison horses (Young et al. 1970). In another study, however, researchers provided evidence suggesting that the amino acids aspartate and glutamate may also be involved in the toxic effects of yellow starthistle on horses (Roy et al. 1995). These amino acids occur at high concentrations in starthistle and have been shown to exert neurotoxic properties in animals. The investigators

suggested that the neurologic disorder in horses following heavy ingestion of yellow starthistle may be caused by a combination of these and other neurotoxins reported to occur in starthistle.

Interestingly, it appears that only horses are affected by ingestion of yellow starthistle. Even mules and burros seem to be unaffected. However, all grazing animals can sustain damage to their eyes from the plant's long sharp spines (Carlson et al. 1990).

Bee industry

Not every aspect of yellow starthistle is detrimental. The weed is regarded as an important honey source plant in California (Edwards 1989, Goltz 1999). In 1959, there were about 150,000 bee colonies that utilized yellow starthistle as a source of pollen and nectar. At that time the estimated the value of honey from yellow starthistle was between $150,000 and $200,000 annually (Maddox et al. 1985). Undoubtedly, the production of yellow starthistle honey has increased since then.